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Bol

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[54] MANUFACTURE OF A ONE PIECE FULL WIDTH INK JET PRINTING BAR

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[73] Assignee: Xerox Corporation, Stamford, Conn.

[21] Appl. No.: 93,915

[22] Filed: Jul. 20, 1993

[51] Int. Cl.[5] B44C 1/22; C23F 1/00; C03C 15/00

[52] U.S. Cl. 156/634; 156/628; 156/644; 156/656; 156/657; 156/901

[58] Field of Search ..... 156/628, 633, 634, 644, 156/655, 656, 657, 668, 901, 902; 346/140 R; 427/271

[56] References Cited

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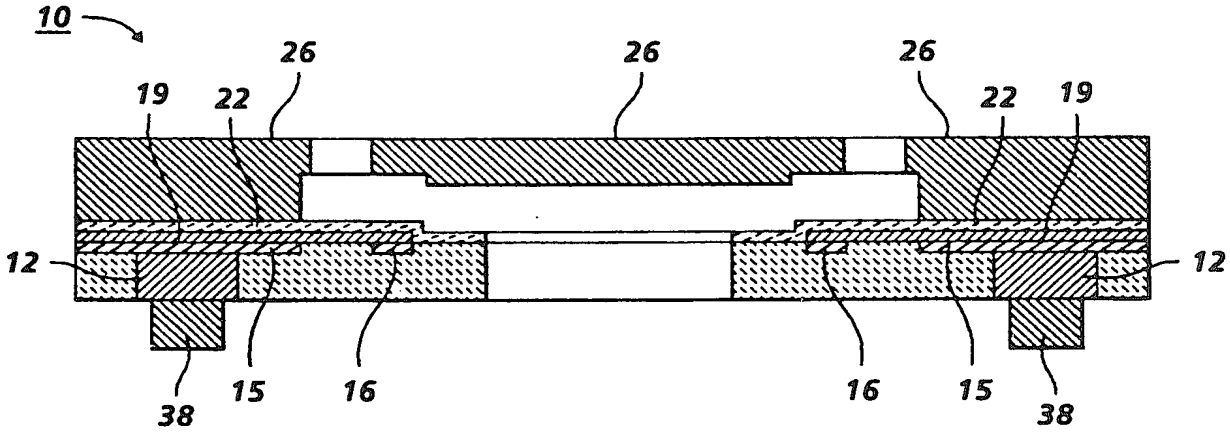
Primary Examiner—William Powell

Attorney, Agent, or Firm—Nola M. McBain

[57] ABSTRACT

A method of manufacturing a one piece full width ink jet printing bar starting with a glass or ceramic plate with conductive vias, metal interconnects and ink feeds preformed on the plate. Heater filaments are formed from a suitable metal such as tungsten, nickel or tantalum on the plate and insulated from the metal interconnects with silicon nitride. Jet chambers and transport chambers to transport the ink from the ink feeds to the jet chambers are formed using sacrificial material and a structural layer. After the structural layer has been patterned the sacrificial material is removed forming the jet chambers and the transport chambers. Bonding bumps are then formed on the reverse side of the ceramic or glass plate from the jet chambers to provide connections to electronic components which determine which ink jet chambers should fire.

6 Claims, 6 Drawing Sheets



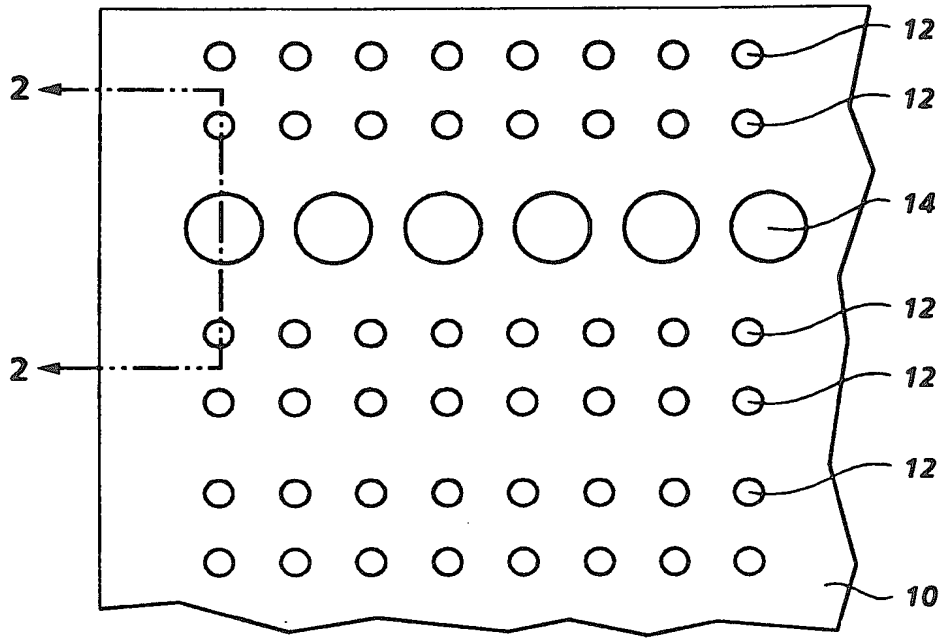


FIG. 1

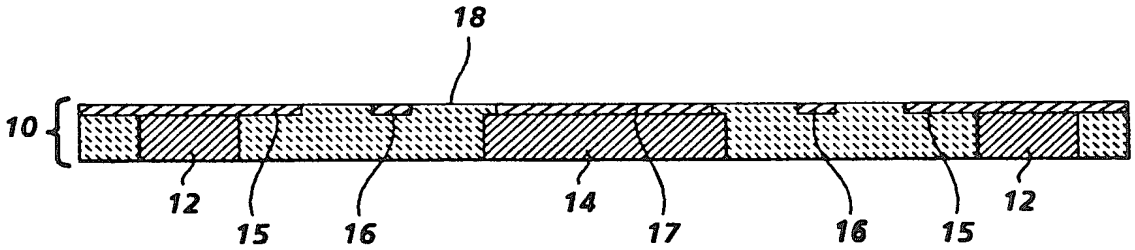


FIG. 2

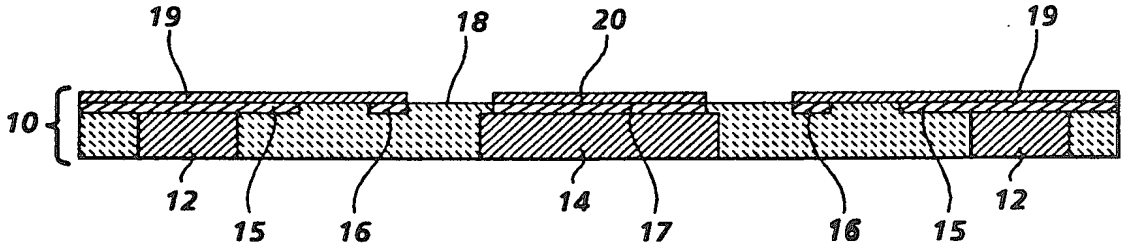


FIG. 3

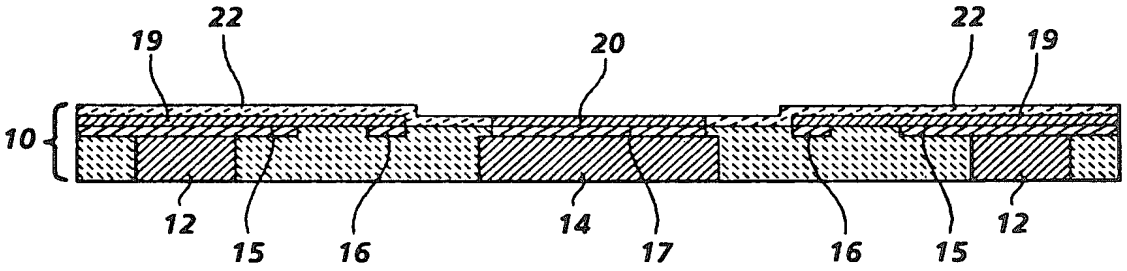


FIG. 4

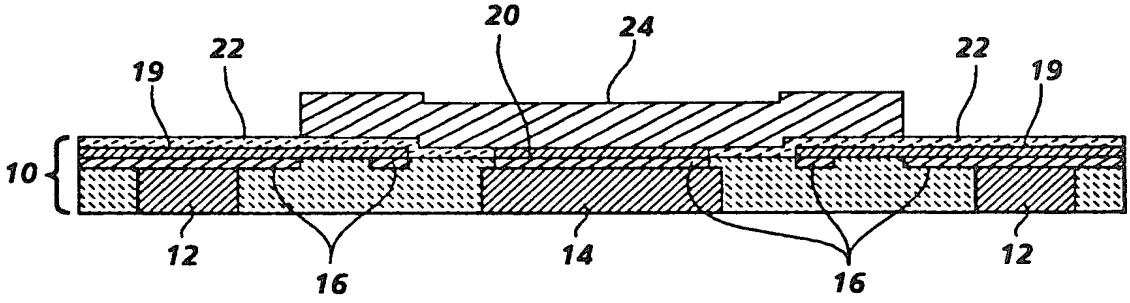
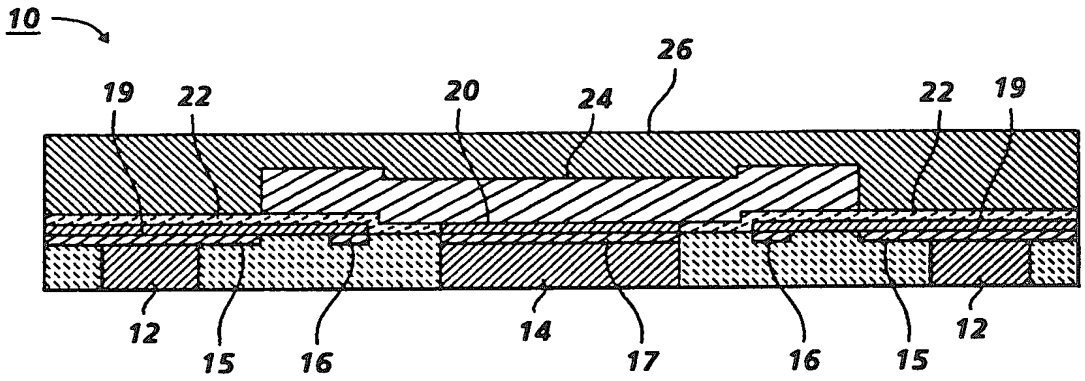


FIG. 5



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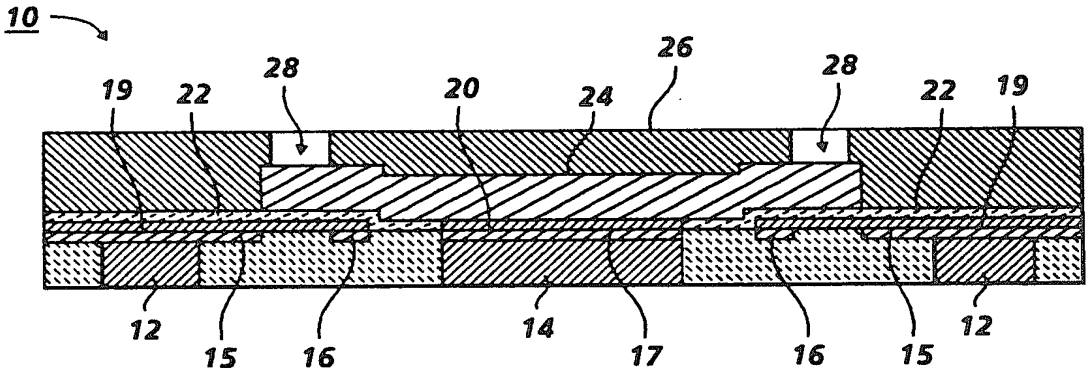

FIG. 7

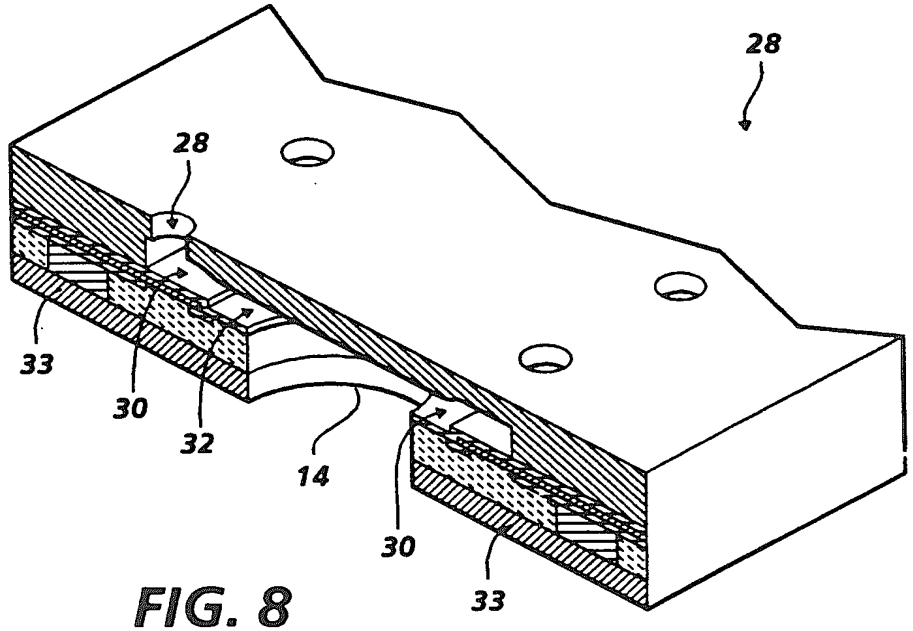

FIG. 8

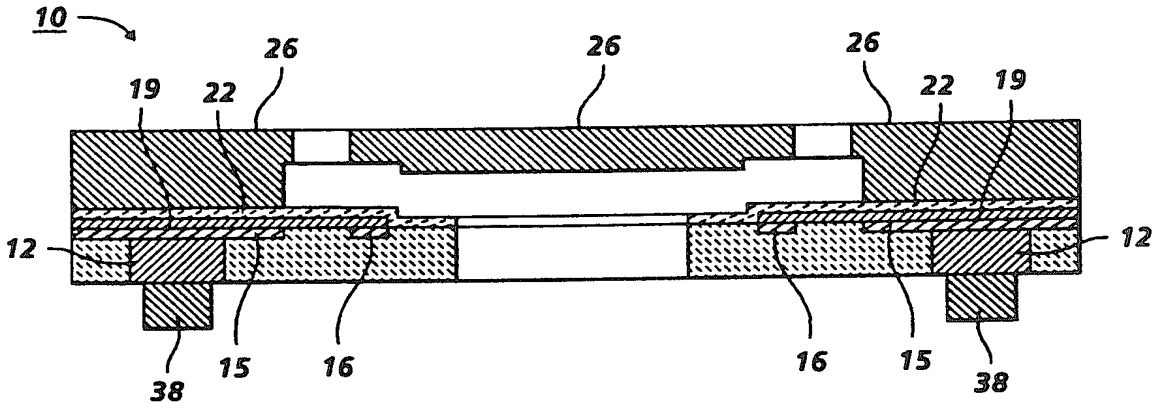
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FIG. 9

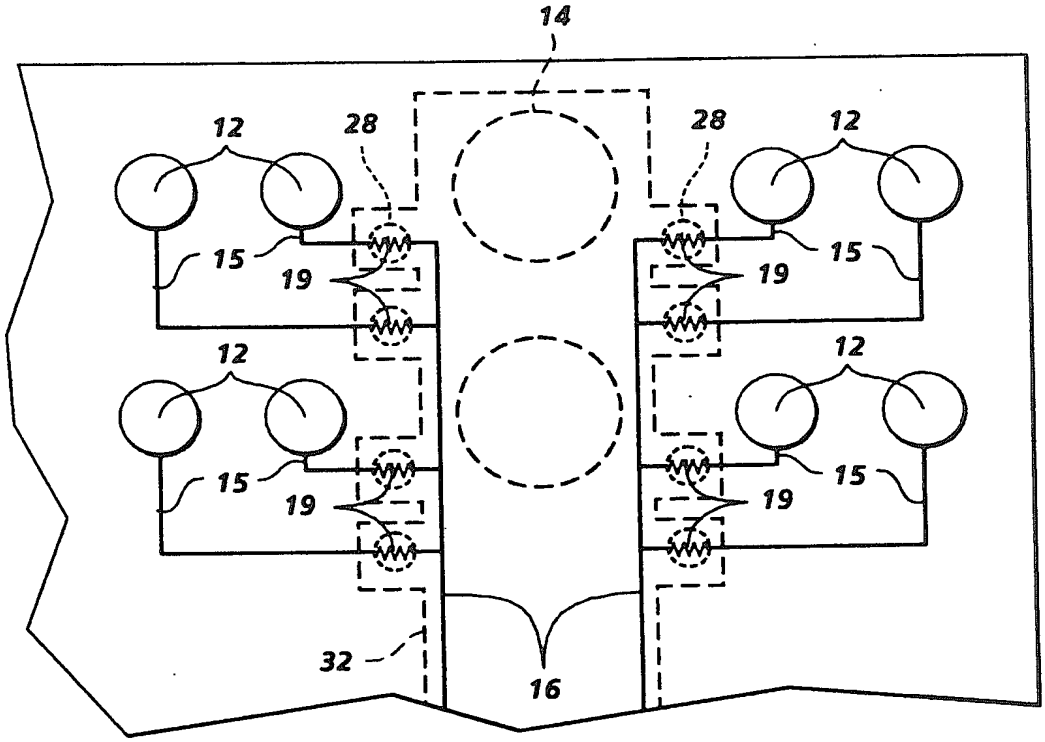
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FIG. 10

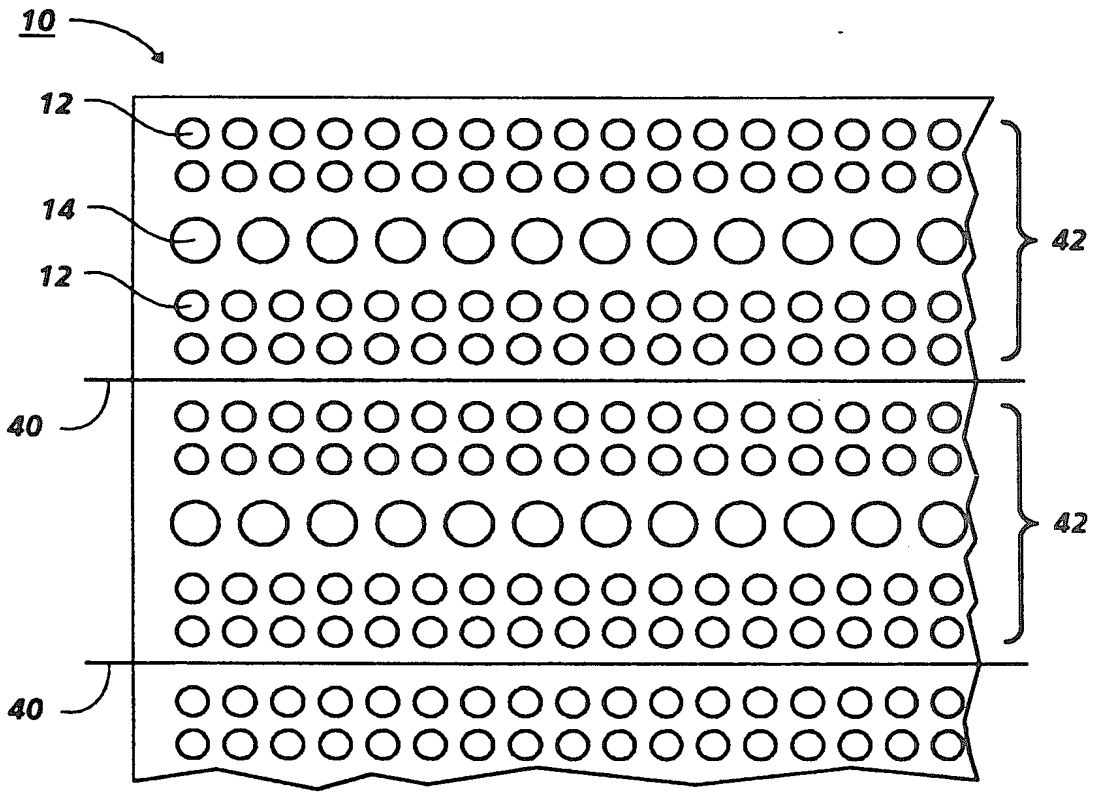

FIG. 11

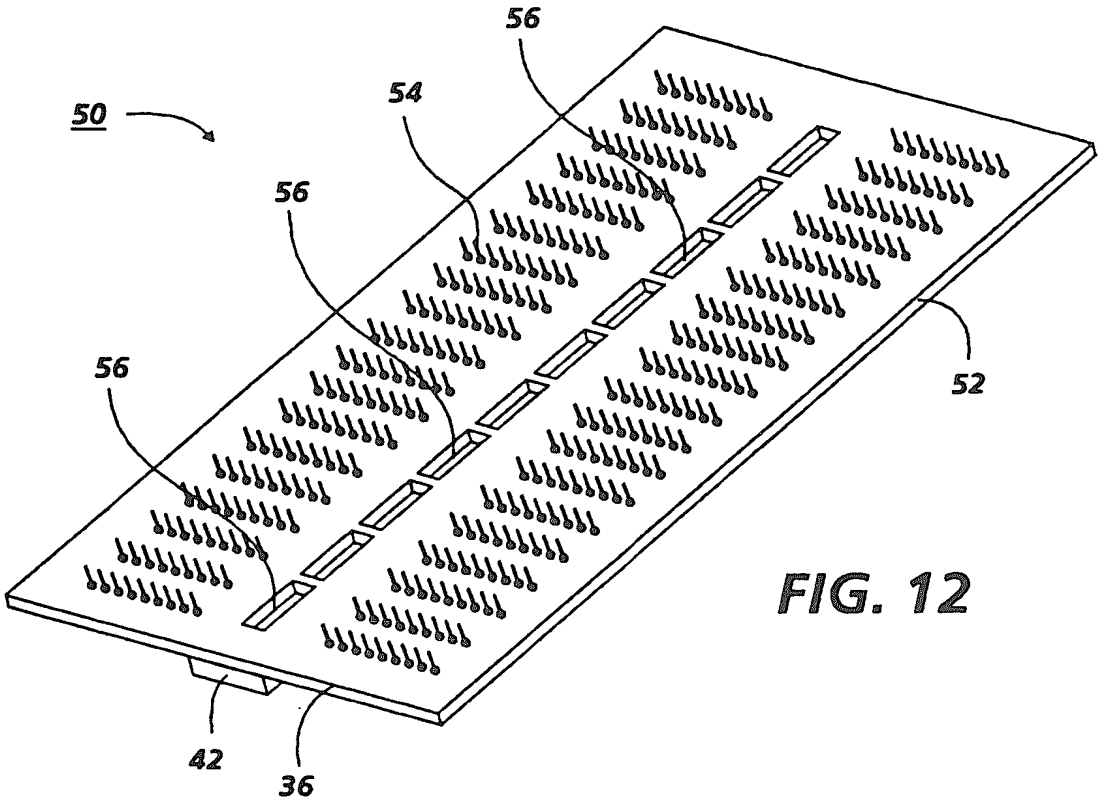

FIG. 12

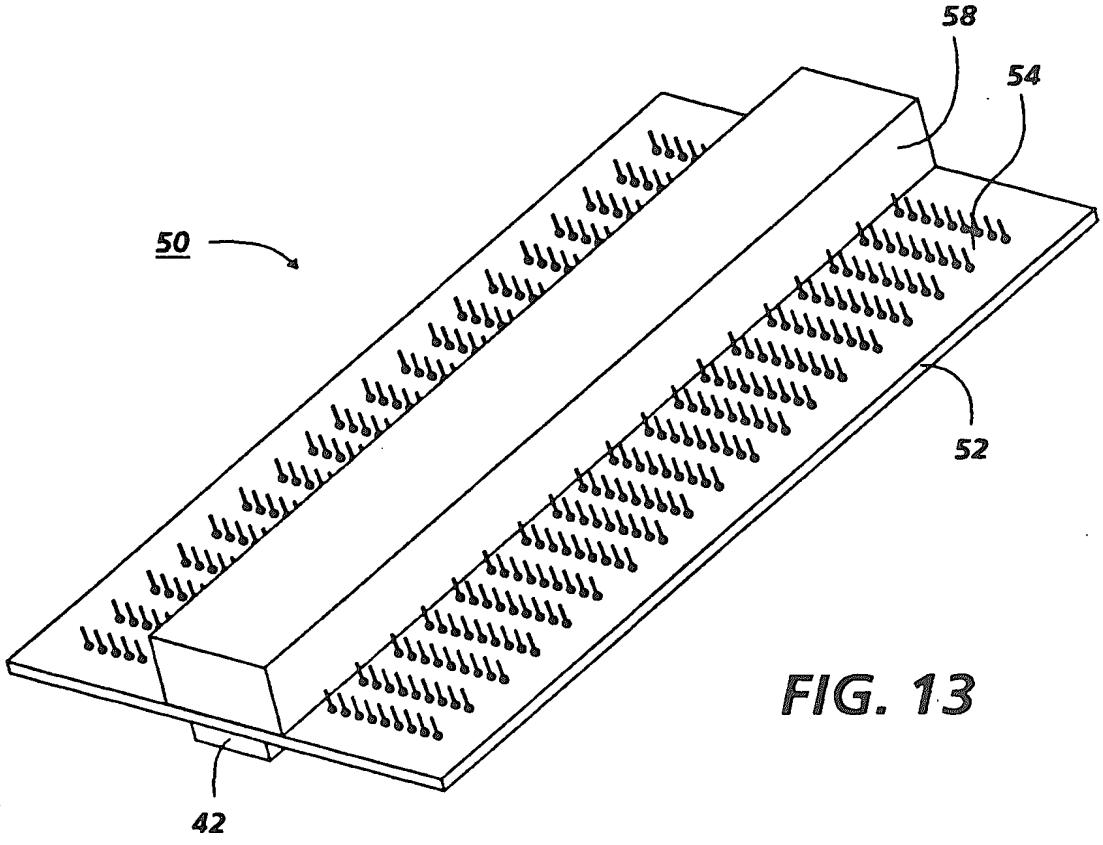

FIG. 13

MANUFACTURE OF A ONE PIECE FULL WIDTH INK JET PRINTING BAR

BACKGROUND

This invention relates generally to ink jet printing systems and more particularly concerns the manufacture of a one piece full width ink jet printing bar in which a glass or ceramic substrate is utilized for a cost effective, disposable printing bar.

If current manufacturing techniques were used, they would require assembling a full width printing bar by precision abutting many smaller printing bars until the desired width is achieved. Assembly of many smaller bars into one larger bar is both time consuming and expensive due to the small tolerance requirements of the abutted parts and the precision required in the final part. Typically, assembly costs may account for 50% of the cost of the printing bar. The large unit manufacturing cost of a full width printing bar contributes to the high cost of printers and replacement parts.

If assembly of multiple parts could be reduced or eliminated, not only would the unit manufacturing costs be considerably reduced but the resulting quality and reliability of the finished product would be increased.

Accordingly, it is the primary aim of the invention to provide a method of manufacturing a full width ink jet printing bar which reduces the number of parts needed to manufacture the printing bar.

Further advantages of the invention will become apparent as the following description proceeds.

SUMMARY OF THE INVENTION

Briefly stated and in accordance with the present invention, there is provided a method of manufacturing a one piece full width ink jet printing bar starting with a glass or ceramic plate with conductive vias, metal interconnects and ink feeds preformed on the plate. Heater filaments are formed from a suitable metal such as tungsten, nickel or tantalum on the plate and insulated from the metal interconnects with silicon nitride. Jet chambers and transport chambers to transport the ink from the ink feeds to the jet chambers are formed using sacrificial material and a structural layer. After the structural layer has been patterned the sacrificial material is removed forming the jet chambers and the transport chambers. Bonding bumps are then formed on the reverse side of the ceramic or glass plate from the jet chambers to provide connections to electronic components which determine which ink jet chambers should fire.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a bottom view of a glass or ceramic plate with metal filled through holes;

FIG. **2** is a cross section taken through line **2—2** of the plate in FIG. **1**;

FIG. **3** is a cross section of the plate in FIG. **2** after depositing heater material;

FIG. **4** is a cross section of the plate in FIG. **3** after depositing insulator material;

FIG. **5** is a cross section of the plate in FIG. **4** after depositing a sacrificial material;

FIG. **6** is a cross section of the plate in FIG. **5** after depositing a structural material;

FIG. **7** is a cross section of the plate in FIG. **6** after patterning structural material;

FIG. **8** is a cross section of the plate in FIG. **7** after removing sacrificial material;

FIG. **9** is a cross section of the plate in FIG. **10** after stripping photoresist material;

FIG. **10** is a schematic of the device created in the steps shown in FIGS. **2–9**;

FIG. **11** is a top view of the plate shown in FIG. **1**;

FIG. **12** is a perspective view of a printing cartridge utilizing the device created in FIGS. **2–12**; and

FIG. **13** is a perspective view of a completed printing cartridge utilizing the device created in FIGS. **2–12**.

While the present invention will be described in connection with a preferred embodiment and method of use, it will be understood that it is not intended to limit the invention to that embodiment or procedure. On the contrary, it is intended to cover all alternatives, modifications and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims.

Numeric list of elements

plate	10
conductive vias	12
ink feeds	14
electrical input	15
ground	16
sacrificial layer	17
front surface	18
heater	19
sacrificial layer	20
insulator material	22
sacrificial layer	24
structural layer	26
orifices	28
jet chambers	30
transport chamber	32
protective layer	33
photoresist layer	34
back surface	36
conductive connections	38
sawing lines	40
bars	42
cartridge	50
printed wiring circuit board	52
pins	54
board ink feeds	56
ink resevoir	58

DETAILED DESCRIPTION OF THE INVENTION

Turning now to FIG. **1**, a glass or ceramic plate **10** is shown with two sizes of through holes filled with metal. The smaller of the holes are approximately 100 μ in diameter. These smaller holes are filled with metal and are conductive vias **12**. The larger of the holes may also be filled with a sacrificial material and will become ink feeds **14**. The ink feeds are approximately 200 μ in diameter and also filled with the same metal as the conductive vias **12**. The metal will later be etched to finish forming the ink feeds **14**. The plate **10** is approximately 2–5 mm thick and is approximately 225 mm square or an approximately 9 inch square. These values were chosen because they are currently used in multichip module fabrication which uses thick-thin film technology and will yield bars capable of printing and 8½ inch strip necessary for full width printing. Many different sizes are used in multichip module fabrication; however, in order to produce full width print bars one dimension must be at least nine inches. It is understood that as the thick-thin film technology progresses it may be possible

connections from each other and are particularly useful when a large number of connections are needed, as in this application. Another well known technique is flip-chip bonding. In the center of the printed wiring circuit board **52** are a series of board ink feeds **56** for supplying ink to the ink feeds **14** on the bar **42**.

The cartridge **50** is completed when an ink reservoir **58** is attached over the board ink feeds **56** as is shown in FIG. **13**. The printing cartridge **50** is now ready to be plugged in for use.

I claim:

1. A method of forming an inkjet printhead comprising the steps of:

a) providing a substrate with conductive vias, conductive interconnects, and ink feeds filled with a first sacrificial material,

b) depositing conductive material on at least a portion of said substrate and said conductive interconnects to form heater elements,

c) depositing non-conductive material on at least a portion of said heater elements to form insulator elements,

d) depositing a second sacrificial material on at least a portion of said insulator elements to define jet chambers and transport chambers,

e) depositing a structural layer completely covering said second sacrificial layer,

f) patterning said structural layer to form orifices and to expose a portion of said second sacrifical layer, and

g) removing said first and second sacrificial layers to form ink feeds, transport chambers and jet chambers.

2. A method of forming an inkjet printhead of claim **1** wherein said heater elements are comprised of tungsten nickel, polysilicon, tantalum nitride, tantalum aluminum, or tantalum.

3. A method of forming an inkjet printhead of claim **1** wherein said first sacrificial material comprises a metal.

4. A method of forming an inkjet printhead of claim **1** wherein said second sacrificial material comprises metal or silicon dioxide.

5. A method of forming an inkjet printhead of claim **1** wherein said structural layer comprises polyimide, PMMA, epoxy or metal.

6. A method of forming an inkjet printhead of claim **1** comprising the additional step of forming conductive connections on said conductive vias.

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